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**New Fodder (Siloed *Shisham* Leaves) for  
Dairy Cows**

BY

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# A New Fodder (Siloed *Shisham* Leaves) for Dairy Cows.

[Received for publication on 26th August 1924.]

In a previous paper<sup>1</sup> some account was given of feeding trials with bullocks in which fresh *shisham* (*Dalbergia sissoo*) leaves were introduced as part of the animal's diet with a view to obtain some knowledge of their digestibility, and to see how far these leaves could be employed as an article of diet in times of fodder scarcity. Full details are given in that paper showing the defects of the fresh leaves, which produce diarrhoea and other digestive disturbances, and it was considered advisable to see whether their value as a fodder could be improved by siloing.

Accordingly about one hundred maunds of *shisham* leaves were gathered in June 1923, and siloed and formed the basis of an elaborate series of digestibility trials on bullocks carried out during the winter of 1923-24, and which will be presented separately. The trials on the dairy cows, a short account of which follows, were a short supplementary experiment carried out to see whether cows would eat this material, and whether the introduction of it into the dietary would have any effect, beneficial or otherwise, on the quantity and quality of the milk yield.

As recounted in the previous paper it will be seen that *shisham* leaves show by chemical analysis a food value comparable with that of green oats, and it was expected that as a result of siloing, the astringent principles would be destroyed and the resulting silage would prove of use.

During the period that the material was in the silo pit samples were taken at intervals and analysed, to determine the changes in chemical composition that take place during the process, and a description of these will be given at the end of this paper.

Four cows, designated as Nasibo, Moni, Rani and Lelan, were selected, and divided into two pairs according to their ages and lactation periods, one pair being between 4 and 5 years old and the other between 6 and 7 years. One animal from each set was an experimental and the other a control animal.

## PRE-EXPERIMENTAL RATION.

This consisted of gram 2 lb., bran 1 lb., cake 1 lb., green stuff 24 lb. and 6 lb. of *bhusa* per animal yielding about an average of 9 lb. of milk

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<sup>1</sup> Mem. Dept. Agri. India, Chem. Ser., VII, No. 4.

daily (for Lelan and Rani), and grain 4 lb., bran 3 lb., cake 2 lb., green stuff 24 lb. and 6 lb. of *bhusa* per animal yielding about an average of 18-19 lb. of milk daily (for Nasibo and Moni).

#### EXPERIMENTAL RATION.

It was decided to replace all the green stuff by an equal quantity of siloed *shisham* leaves, but only about 15 lb. were usually eaten by each

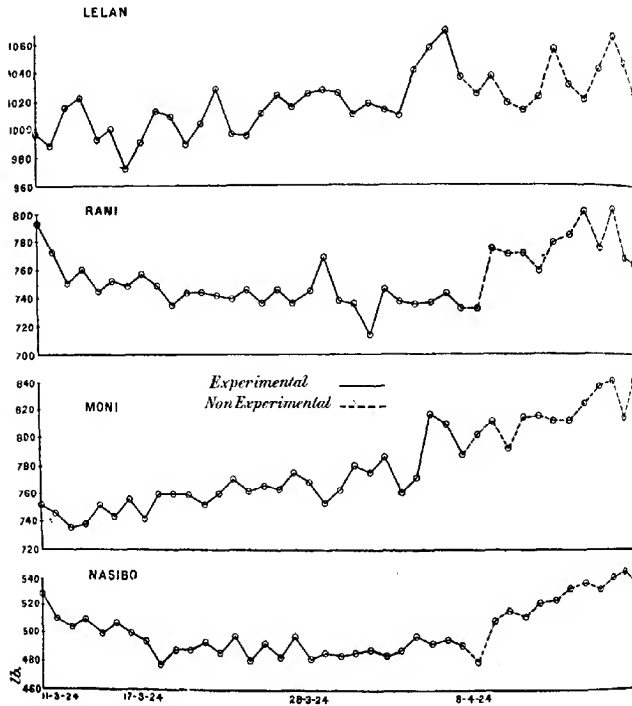


Fig. 1 Body Weight Curve.

animal per day, it being apparently necessary to educate the animals' taste to the new fodder.

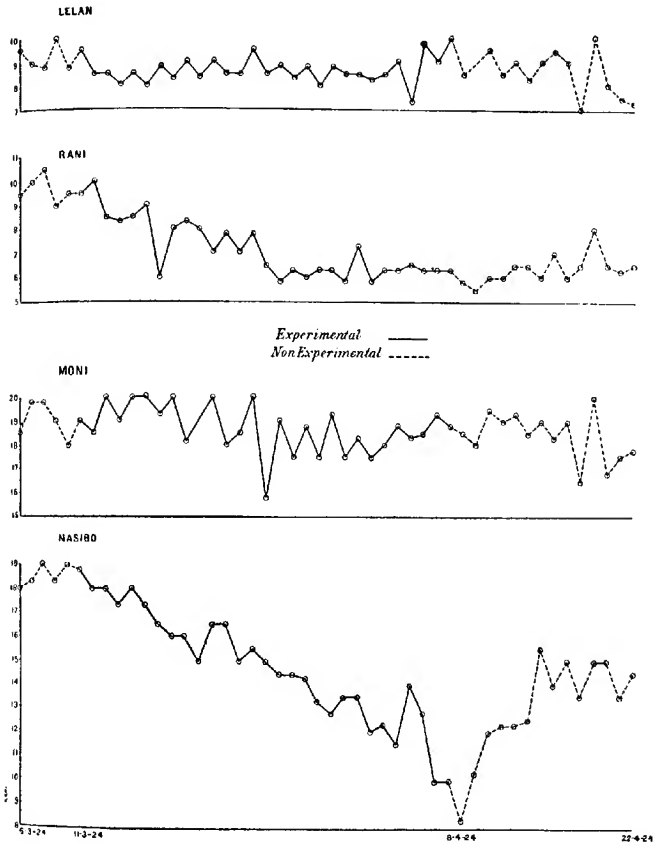


Fig. 11. Milk Yield Curve.

Both animals decreased somewhat in weight after being put on the *shisham* diet, after which the weights remained steady and tended to rise as the animals became accustomed to it and ate more. The weights of all four animals during the course of the trial are shown in Fig. 1. The animal named Nasibo was the smallest of all and showed the greatest fluctuation in milk yield, although her weight remained pretty constant.

#### MILK YIELD.

Full details of the milk yield are shown in Fig. II.

Taking the first pair of animals, Nasibo and Moni, we note that before the feeding of *shisham* commenced the daily average yield of milk was, for the control animal Moni, about 14.9 lb. in February and 18.9 lb. in March, and for the experimental animal Nasibo, 18.4 lb. in February and 18.1 lb. in March. Feeding commenced on March 12th and during the ensuing month on the *shisham* diet the average daily yield of the control animal was about the same, while that of the experimental animal was 14.6 lb., but it will be noted that the yield from this animal fell still further later on after it was put back on the ordinary diet, and the fall may be due to seasonal influences. Thus the yield in April after the animal had been put back on to the ordinary farm diet was only 13.1 lb. The daily average yield for the control animal in this after-period was 18.4 lb., being a slight drop. In interpreting any rise or fall in the daily yield both during and after the *shisham* feeding period, we have to consider also the fluctuations shown by the control animals and also the seasonal rise or fall as the case may be.

In the case of the second pair of animals, Lelan and Rani, the daily average yield of milk for the control animal Lelan was 8.4 and 9 lb. during February and March respectively up to the time the *shisham* feeding commenced. The daily average for the experimental animal Rani was 9 lb. for February and 9.6 lb. for March. During the following month the average daily yield for the control animal Lelan was 8.6 lb. showing a slight decrease, while for the experimental animal it was about 7.1 lb. showing likewise a decrease. After being replaced on the normal diet the experimental animal showed a slight decrease in the daily milk yield which averaged 6.4 lb.

The analyses of the milk, carried out daily, are shown in Tables I and II from which it will be seen that there is practically no difference at all in the composition of the milk from the two sets of animals. Furthermore, the milk from the *shisham* fed animals was entirely free from any unusual taste.

TABLE I.

*Nasibo (Silo Fed).*

[illegible]



*Moni (Control).*

Date	QUANTITIES PER 100 GRAMS OF MILK									
	Date		P.		F.		NITROGEN		NITROGEN	
	Daily weights		Milk yield		Specific gravity at 60° F.		Solids not fat by difference		Solids by difference	
	lb.	lb.	lb.	lb.	Pat.	Total solids	Ash	Lactose	Total	Casein
March 16/24.										
7th . . .	18.50	10.20	4.0	13.42	0.42	..	..	0.52	..	..
8th . . .	15.75	10.20	4.0	13.71	0.71	..	..	0.53	0.41	0.12
9th . . .	10.75	10.20	4.5	14.29	0.70	..	..	0.63	0.48	0.15
9th . . .	10.06	10.51	4.3	13.93	0.63	0.66	..	0.54	0.40	0.14
10th . . .	18.01	10.50	3.9	13.22	0.62	0.63	..	..	..	..
11th . . .	14.00	10.25	4.4	13.43	0.53	0.65	..	..	..	..
12th . . .	7.46	10.20	1.1	13.42	0.32	0.72	..	..	0.41	..
13th . . .	20.40	10.30	4.5	14.10	0.50	0.68	..	..	0.13	..
14th . . .	23.82	10.40	4.8	11.20	0.40	0.68	..	..	..	..
15th . . .	22.00	10.30	4.8	13.45	0.65	0.68	..	..	0.41	..
16th . . .	24.4	10.31	4.7	13.96	0.36	0.65	..	..	0.42	..
17th . . .	7.56	10.25	0.26	12.07	7.87	0.68	..	0.40	0.31	0.12
18th . . .	7.42	20.40	10.30	14.01	0.41	0.74	..	Spilled	..	..
19th . . .	7.01	18.00	10.27	13.01	0.11	0.75	..	..	0.41	..
20th . . .	7.80	18.00	10.29	14.16	8.90	0.63	..	..	0.40	..
21st . . .	7.59	20.40	10.29	13.56	0.26	0.67	..	..	0.41	..
22nd . . .	7.52	18.00	10.31	13.02	0.72	0.70	..	..	0.41	..
23rd . . .	7.01	18.50	..	4.5	13.63	0.45	Spilled	..	..	..
24th . . .	7.20	20.40	10.30	14.30	0.40	0.70	..	..	0.32	..
25th . . .	7.61	15.75	10.29	14.30	0.40	0.70	..	..	0.36	..
26th . . .	7.65	19.00	10.30	13.71	0.11	0.30	..	0.49	0.38	0.11
27th . . .	7.62	17.50	10.29	13.74	8.54	0.71	4.94	0.50	0.29	0.11
28th . . .	7.73	18.75	10.29	13.99	0.00	0.66	5.13	0.51	0.39	0.12
29th . . .	7.68	17.50	10.31	11.12	0.52	0.69	4.98	0.54	0.40	0.14
30th . . .	7.52	19.25	10.29	14.19	0.30	0.69	5.43	0.52	0.40	0.12
31st . . .	7.61	17.50	10.31	14.05	0.65	0.70	4.59	0.52	0.40	0.12
April.										
1st . . .	7.81	13.25	10.30	13.68	0.28	0.76	4.07	0.53	0.43	0.10
2nd . . .	7.75	17.50	10.30	13.95	0.13	0.74	0.43	0.51	0.41	0.09
3rd . . .	7.80	18.00	10.31	13.62	0.23	0.65	4.30	0.52	0.46	0.10
4th . . .	7.90	18.75	10.29	14.40	0.60	0.65	3.21	0.33	0.11	0.02
5th . . .	7.71	18.25	10.29	14.00	0.00	0.75	5.50	0.50	0.24	0.06
6th . . .	8.16	18.50	10.26	15.30	0.40	0.64	5.01	0.50	0.40	0.10
7th . . .	8.15	18.50	10.29	14.10	0.00	0.66	5.00	0.51	0.40	0.10
8th . . .	7.88	18.75	10.30	11.02	0.22	0.66	5.73	0.50	0.42	0.

TABLE II.

*Rani (Silo Fed).*

Date	DAILY RATION EATEN		Body weight	Milk yield	Specific gravity at 60° F.	QUANTITIES PER 100 GRAMS OF MILK							
	Ensilaged leaves	Blusa				Fat	Total solids	Solids not fat by differ- ence	Ash	Lactose	Nitrogen		
											Total	Casein	Soluble by differ- ence
	lb.	lb.	lb.	lb.									
March 1924													
6th	..	..	..	9:0	1029	51	16:23	11:13	..	..	0:61	..	..
7th	..	..	..	..	10:0	50	15:86	10:46	..	..	0:58	0:51	0:07
8th	..	..	..	10:20	10:0	50	11:44	9:44	..	..	0:53	0:42	0:11
9th	..	..	..	..	9:0	57	14:09	9:29	0:69	..	..	0:48	..
10th	..	..	..	..	10:51	58	15:37	9:57	0:63	..	..	..	..
11th	..	..	..	7:32	9:50	1028	58	15:59	9:50	0:78	..	..	..
12th	1:0	..	..	7:72	10:00	1028	59	15:53	9:63	0:79	..	0:48	..
13th	1:0	..	..	7:51	8:50	1028	59	15:08	9:78	0:72	..	..	..
14th	..	..	..	7:60	8:25	1027	60	15:15	9:15	0:77	..	0:45	..
15th	1:0	1	..	7:44	8:50	1027	62	14:71	8:51	0:69	3:61	0:45	0:16
16th	2:0	1	..	7:32	9:0	1029	63	15:10	8:80	0:70	..	0:49	..
17th	6:0	1	..	7:18	8:00	1027	63	13:42	9:12	0:75	0:57	0:43	0:14
18th	6:0	1	..	7:56	8:00	1024	65	15:00	8:40	0:78	..	0:44	..
19th	7:5	1	..	7:48	8:25	1026	68	15:38	8:58	0:71	..	0:44	..
20th	8:5	1	..	7:34	8:00	1027	65	14:89	8:39	0:71	..	0:46	..
21st	10:5	2	..	7:43	7:00	1025	60	14:56	8:56	0:70	..	0:43	..
22nd	6:5	2	..	7:45	7:75	1027	63	15:00	8:70	0:75	..	0:42	..
23rd	5:0	2	..	7:41	7:00	1026	58	14:90	9:10	0:76	0:55	0:39	0:16
24th	10:5	2	..	7:39	7:75	1025	58	14:11	8:31	0:76	0:54	..	..
25th	11:0	4	..	7:45	6:0	1026	68	15:07	8:37	0:68	..	0:39	..
26th	9:0	4	..	7:35	5:75	1026	68	14:71	8:41	0:66	..	0:50	0:42
27th	18:5	2	2	7:45	6:25	1026	71	15:34	8:24	0:74	4:07	0:37	0:14
28th	22:0	..	2	7:55	6:40	1026	74	15:32	8:02	0:72	4:14	0:59	0:43
29th	17:0	..	..	7:49	6:25	1026	71	15:61	8:51	0:70	4:06	0:55	0:20
30th	17:5	..	..	7:68	6:25	1025	68	15:14	8:34	0:73	4:32	0:55	0:40
31st	11:5	..	..	7:38	5:75	1025	62	14:33	8:03	0:67	3:73	0:40	0:39
April													
1st	..	13:5	..	7:35	7:25	1034	66	14:13	7:53	0:70	3:82	0:51	0:11
2nd	..	10:0	..	7:13	5:75	1025	69	15:02	8:12	0:68	3:91	0:54	0:10
3rd	..	27:5	..	7:15	6:25	1024	59	13:98	8:08	0:62	4:18	0:32	0:15
4th	..	33:5	..	7:36	6:25	1024	67	14:87	8:17	0:74	4:21	0:52	0:38
5th	..	22:5	..	7:35	6:50	1021	70	13:08	8:08	0:74	4:54	0:55	0:39
6th	..	22:0	..	7:30	6:25	1025	62	15:13	8:95	0:70	4:47	0:57	0:43
7th	..	16:0	..	7:42	6:25	1028	63	14:87	8:57	0:74	4:25	0:56	0:42
8th	..	9:0	..	7:32	6:25	1024	68	15:22	8:12	0:73	4:20	0:54	0:13
9th	..	..	..	7:32	5:75	..	..	..	..	..	..	..	..
10th	..	..	..	7:74	5:50	..	..	..	..	..	..	..	..
11th	..	..	..	7:70	6:00	..	..	..	..	..	..	..	..
12th	..	..	..	7:71	6:00	..	..	..	..	..	..	..	..
13th	..	..	..	7:59	6:50	..	..	..	..	..	..	..	..
14th	..	..	..	7:78	6:50	..	..	..	..	..	..	..	..
15th	..	..	..	7:83	6:00	..	..	..	..	..	..	..	..
16th	..	..	..	8:00	7:00	..	..	..	..	..	..	..	..
17th	..	..	..	7:74	6:00	..	..	..	..	..	..	..	..
18th	..	..	..	8:02	6:50	..	..	..	..	..	..	..	..
19th	..	..	..	7:67	8:00	..	..	..	..	..	..	..	..
20th	..	..	..	7:64	6:50	..	..	..	..	..	..	..	..
21st	..	..	..	7:66	6:25	..	..	..	..	..	..	..	..
22nd	..	..	..	7:68	6:50	..	..	..	..	..	..	..	..

*Lelan (Control).*

Date			Specific gravity at 60° F.	QUANTITIES PER 100 GRAMS OF MILK								
	Pork weight	Milk yield		Fat	Total solids	Solids not fat by difference	Ash	NITROGEN				
								Lactose	Total	Caselin	Soluble by difference	
	lb.	lb.										
March 1924.												
6th	..	9.50	1029	4.8	14.10	9.30	..	..	0.62	..	..	
7th	..	9.00	1029	4.9	14.43	9.43	..	..	0.62	0.50	0.12	
8th	..	8.75	1030	4.6	13.87	8.27	0.66	..	0.64	0.48	0.16	
9th	..	10.00	1029	4.2	14.33	10.13	0.78	..	..	0.47	..	
10th	..	8.75	1031	5.0	14.02	9.02	0.09	..	..	..	..	
11th	9.06	9.50	1030	4.5	13.72	9.22	0.75	..	..	..	..	
12th	9.66	8.50	1029	5.4	14.55	9.15	0.80	..	..	0.49	..	
13th	1.022	8.00	1029	5.2	14.87	9.47	0.65	..	..	..	..	
14th	9.62	8.50	1029	5.4	13.89	8.09	0.71	..	0.64	..	..	
15th	1.060	8.00	1030	5.3	13.84	8.54	0.85	..	..	0.61	..	
16th	9.72	8.75	1029	5.3	14.40	9.10	0.69	..	..	0.57	0.44 1/2	
17th	9.00	8.25	1029	5.2	14.22	9.02	0.69	..	..	..	..	
18th	1.012	9.00	1028	4.9	13.86	8.06	0.79	..	..	0.46	..	
19th	1.008	8.25	1029	5.5	14.43	8.63	0.73	..	..	0.49	..	
20th	9.88	9.00	1029	5.3	14.18	8.88	0.74	..	..	0.49	..	
21st	1.003	8.50	1028	4.8	13.94	9.14	0.78	..	..	0.46	..	
22nd	1.028	8.50	1029	5.0	14.47	9.47	..	..	..	0.47	..	
23th	9.95	9.50	1030	5.3	14.58	9.28	0.87	..	..	0.45	..	
24th	9.40	8.50	1028	5.3	13.95	8.65	0.70	..	0.56	0.43	0.13	
25th	1.015	8.75	1029	5.3	14.01	8.51	0.82	4.29	0.58	0.32	0.10	
26th	1.023	8.25	1029	5.5	14.53	9.23	0.77	4.11	0.60	0.46	0.14	
27th	1.044	8.75	1028	5.3	14.80	9.40	0.76	4.40	0.63	0.48	0.15	
28th	1.024	8.00	1029	5.4	14.80	9.40	0.76	4.40	0.63	0.48	0.15	
29th	1.027	8.75	1028	5.3	14.48	9.18	0.88	4.78	0.61	0.47	0.14	
30th	1.024	8.50	1028	5.2	14.32	9.12	0.75	4.21	0.60	0.45	0.15	
April.												
1st	1.009	8.50	1024	5.2	14.20	9.00	0.87	4.58	0.58	0.48	0.10	
2d	1.017	8.25	1028	5.4	14.13	8.73	0.81	4.50	0.58	0.45	0.13	
3d	1.012	8.50	1029	5.2	14.11	8.86	0.76	4.35	0.60	0.44	0.16	
4th	1.006	9.00	1028	5.3	14.21	8.91	0.86	4.54	0.57	0.45	0.12	
5th	1.010	7.25	1028	5.6	14.90	9.10	0.85	4.62	0.59	0.47	0.12	
6th	1.056	9.75	1028	5.2	14.23	9.13	0.75	4.32	0.57	0.45	0.12	
7th	1.067	9.00	1027	5.1	13.70	8.60	0.61	4.31	0.59	0.45	0.14	
8th	1.063	10.00	1028	5.1	14.50	9.10	0.84	4.60	0.62	0.49	0.13	
9th	1.024	8.50	..	..	..	..	..	..	..	..	..	
10th	1.036	9.00	..	..	..	..	..	..	..	..	..	
11th	1.017	9.50	..	..	..	..	..	..	..	..	..	
12th	1.012	8.75	..	..	..	..	..	..	..	..	..	
13th	1.021	8.00	..	..	..	..	..	..	..	..	..	
14th	1.053	8.25	..	..	..	..	..	..	..	..	..	
15th	1.039	9.00	..	..	..	..	..	..	..	..	..	
16th	1.020	9.50	..	..	..	..	..	..	..	..	..	
17th	1.011	9.00	..	..	..	..	..	..	..	..	..	
18th	1.044	7.40	..	..	..	..	..	..	..	..	..	
19th	1.046	10.00	..	..	..	..	..	..	..	..	..	
20th	1.026	8.00	..	..	..	..	..	..	..	..	..	
21st	1.017	7.50	..	..	..	..	..	..	..	..	..	
22nd	1.020	7.25	..	..	..	..	..	..	..	..	..	

Care was taken in feeding *shisham* leaves to feed it after milking, thus obviating any possible contamination of the milk. Further knowledge might have been obtained if the supply of *shisham* had been sufficient to continue the trials for a longer time, but taking into consideration the fact that the cows had to become accustomed to the new taste of the *shisham* and also the possible seasonal changes in the milk yield the results obtained over this short period indicate that siloed *shisham* can, within certain limits, be fed as a substitute for green fodder, without untoward results on the animals or their milk yield. It is hoped that some further trials may be carried out in this direction.

Table III gives some particulars of the four cows under observation.

TABLE III.

Name of the cow	Age on 5-3-24	Date of calving	Date of service	February average daily yield of milk	March average daily yield of milk	REMARKS
	Yr. Mth.			lb.	lb.	
Nasibo . .	4 9½	11-1-24	5-5-24	18-4	18-1	
Moni . .	4 10½	24-1-24	25-4-24	14-9	18-9	
Rani . .	7 2	3-7-23	25-9-23	9-0	9-6	
Lelan . .	6 10	1-7-23	3-10-23	8-4	9-0	

ANALYTICAL DATA, ETC., CONCERNING *shisham* LEAVES.

The *shisham* leaves were gathered between the 20th and 23rd June 1923, and packed tightly into the silo pit which was 8 feet in diameter and 6 feet deep, and was lined at the sides and bottom with dry straw. The pit was filled level with the ground and pressed tightly down by bullocks and the final level again made up to ground level after which a layer of straw was placed over the top, and about two feet of dry earth over this, so as to provide a slope which would ensure the pit remaining dry in the wet season.

An analysis was made of the fresh leaves when gathered and also at intervals during the course of the siloing, and the results are shown in Table IV.

TABLE IV.

*Shisham leaves ensilaged.*

Results expressed in c.c. N per 100 gm. dry matter.

	Fresh <i>Shisham</i> leaves 21-6-23	16-8-23		30-10-23		17-12-23		31-1-24		24-3-24
		I 20"	II 20"	I 20"	II 20"	I 20"	II 20"	I 20"	II 20"	II 20"
1. Volatile organic acid.	..	8.2	13.5	34.4	72.7	70.5	104.7	70.7	90.5	111.7
2. Amino-acids (with amides of asparagin type).	..	46.3	36.5	53.0	125.7	37.5	67.2	28.8	26.2	36.4
3. Volatile bases.	..	23.1	24.3	17.9	32.5	40.3	57.9	28.5	55.6	73.3
4. Moisture.	73.11	71.80	73.20	68.03	74.23	..	70.12	..	74.20	75.00
5. Dry matter.	26.89	28.20	26.80	31.97	25.77	..	29.88	..	25.80	24.00
6. Ash.	5.14	4.50	4.80	4.97	4.28	..	4.78	..	4.70	4.41
7. Fat.	0.81	0.70	0.88	0.72	0.83	..	0.81	..	0.83	0.85
8. Crude fibre.	7.40	6.00	8.68	9.17	8.56	..	7.85	..	7.45	7.50
9. Total nitrogen.	0.69	0.76	0.74	0.79	0.67	..	0.79	..	0.71	0.65
10. True protein nitrogen.	0.57	0.64	0.54	0.42	0.32	..	0.61	..	0.53	0.41
11. Amide nitrogen.	0.02	0.12	0.11	0.13	0.15	..	0.07	..	0.04	0.02

A glance at this table will show that all the ordinary ingredients of the fresh leaves have preserved their figures within certain small limits, and only in the case of the amide nitrogen is there any wide variation, this rising considerably and then afterwards falling.

A good silage should, in particular, retain its moisture and total nitrogen more or less intact, and this has been well achieved in this case.

It was also thought advisable to obtain some information on the volatile organic acids and bases and amino-acids, and the figures obtained during the course of the experiment are also shown.

The amino-nitrogen was estimated by Sorensen's formaldehyde method, and some difficulty was experienced owing to the colour of the solutions, which perhaps introduced some margin of error. It is proposed to repeat these observations during the ensuing year using the Van Slyke method for estimating amino-nitrogen.

The estimations of the volatile acids and bases were carried out according to the method employed by Amos and Woodman (*Jour. Agri. Sc.*, Vol. 12, Pt. 4, 1922).

We note that the volatile organic acids rise continuously during the period under trial, as do the volatile bases also, while the amino-acids rise at first and then fall.

The siloed leaves during the successive samplings had a fresh, pleasant, aromatic smell, were greenish-brown in colour, and were practically free from any mould or decomposition, and it was particularly noted that the mucilaginous substance which was very noticeable in the fresh leaves was absent in the siloed material. This may have been the cause of the original digestive trouble with animals fed on the green leaves, as no such effects were noted with the siloed leaves.

#### CONCLUSIONS.

1. The method of siloing *shisham* leaves as described is a satisfactory one for producing a reserve fodder in times of scarcity.

2. In the period of time employed the animals required to become accustomed to the new taste introduced into the ration and this may account for the small decline in weight, and small fluctuations in milk yield, but as the animals became accustomed to it they ate more, and it may be expected that a longer period of trial would have indicated still further that the siloed leaves could act as an efficient substitute for the basal green fodder in the ration.

3. No deleterious effect whatever was noted in the quality of the milk of the animals fed on the leaves, the yield was fairly maintained, and the animals remained in perfectly good health throughout the period of trial.

In conclusion, the authors wish to express their appreciation of the valuable assistance rendered by Mr. Stewart, Professor of Agriculture, in providing the animals, and to Bh. Balwant Singh Mahon, B.Sc., Research Assistant, for assistance in carrying out the analysis.



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